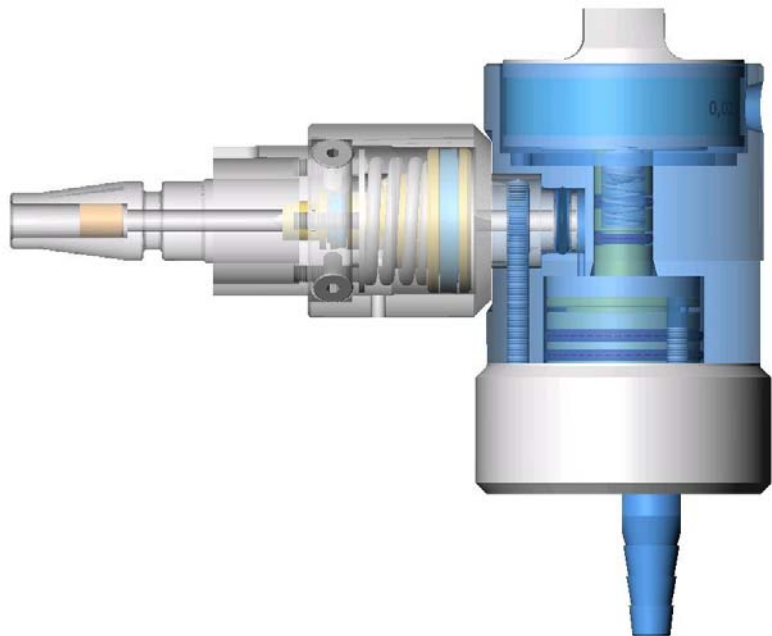

Micro Flowmeter

Pt # 816-XXXX (all models)

Service Manual



Micro Flowmeter

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1.0 Description of Symbols



Attention, see Instructions for Use



Use no oil



Ascending diagonal line on the decal label indicates increase in flow

2.0 Product Description

Micro flow describes oxygen therapy at flow rates below 100 cc/min. Primarily flows this low are used in the weaning of neonates from their oxygen dependency.

The Micro Flowmeter provides 11 distinct flow rates, which enables the therapy to be moved from one step to the next always knowing that the flow at each step is the same as the previous time the rate was selected. This enables some level of control and in most cases it is the case that the absolute level is not important but the ability to step up or down in distinct stages to suit the infants needs. This is not possible with a variable ball-in-glass type flowmeter.

Cutting edge techniques are used to manufacture the flow metering plates, which require orifice sizes measured in microns. To prevent blockage of such small holes the device has two layers of filtration, a 40 micron filter at the input probe and a 5 micron immediately in front of the metering plate.

Change in output flow as a result of changes to the input pressure (either static or transient changes in line pressure) a pre-regulator is built into the device, which provides a stable internal supply pressure irrespective of the line pressure to which the device is connected. This ensures that wherever, or whenever, the device is fitted the flow rate at any setting is always the same.

Finally, the device is of all-metal construction and will not break if dropped or knocked. This ensures that it will continue providing the therapy required by the patient.

3.0 Approvals

Micro Flowmeter is a CE Marked device in accordance with the Medical Device Directive (93/42/EEC) and meets the requirements of the following Harmonised Standards:

EN738-1.....Pressure Regulators and Pressure Regulators with Flowmetering Devices

4.0 In-House Servicing

It is strongly recommended that Micro flowmeters with a **Service Due Date** of **Jan 04** or earlier should be returned to BPR Medical for a chargeable, standard service prior to any attempts to service the device in-house. Several important upgrades have been implemented on devices manufactured or serviced after December 2002 that would not be included on devices built prior to this time. Upgrades are included in a standard service at no extra charge.

5.0 General Safety Warnings

- W1 Before using or servicing this equipment read through the entire instruction manual. Attempting to use this equipment without an appreciation of its correct operation, its limitations and the general safety warnings associated with compressed oxygen may result in patient or user injury.
- W2 Oxygen therapy may be a critical treatment. A micro flowmeter should be used in strict accordance with the prescription and instructions of a qualified clinician. The effectiveness of supplemental oxygen therapy can only be determined by continuous monitoring of blood oxygen levels. It is essential that PaO₂ or SpO₂ monitoring is carried out when supplemental oxygen is prescribed.
- W3 When the micro flowmeter is turned off isolate the patient from the equipment by disconnecting the delivery tube from either the patient or the micro flowmeter.
- W4 Only appropriately trained service personnel working in controlled conditions must perform disassembly, assembly and testing of this equipment.
- W5 Do not submerge in water or allow any fluid to enter the equipment. If you have reason to suspect that fluid or other ingress has occurred remove the device from use and contact the manufacturer.
- W6 The performance of the device may be affected if it is stored or transported in temperatures outside of the range -20°C to +60°C.
- W7 Check the cylinder contents before use and at regular intervals during use, as low cylinder pressure may result in poor or non-performance of the equipment. Always change the oxygen cylinder when the oxygen cylinder contents gauge is showing red.
- W8 The accuracy of the micro flowmeter may be effected if the input pressure is other than that stated in the specifications.
- W9 Oxygen is not flammable, but the presence of oxygen will drastically increase the rate and severity of combustion. Hydrocarbons such as oil or grease become highly combustible in the presence of oxygen. Oxygen must never be allowed to contact oil, grease or other petroleum-based substances.
- W10 Never administer oxygen while smoking or when near an open flame.
- W11 Oxygen cylinders have fill pressures up to 20 000 kPA (200 Bar). Never use medical oxygen from a cylinder without first reducing the pressure to a safe level through a suitable pressure regulator.
- W12 Never use oxygen as a pressure medium to purge obstructed pipelines or equipment, to operate pneumatic tools, or to build up any pressure in tanks.
- W13 Never permit compressed medical gases to enter a regulator suddenly. Always open the cylinder valve slowly. Do not stand in front of a regulator outlet when opening the cylinder valve.
- W14 Do not use or store oxygen equipment near excessive heat (>50°C or 125°F) or an open flame.
- W15 Use only lubricants recommended by the manufacturer when servicing the Micro Flowmeter. The use of lubricants other than those recommended by the manufacturer may result in fire or explosion.

6.0 Inspection and Maintenance Periods

Periodic Inspection (Every 6 Months)

Can be performed within the Ward environment. Includes visual inspection of device and basic check on flow rates at each setting. Requires appropriate test equipment. Requires no replacement parts.

Full Service (Every 2 Years)

Strip down Service and functional check. Requires appropriate test equipment, replacement parts and suitable workshop conditions.

7.0 Specification

General

Operating, Storage and Transport

Temperature Range -20°C to 60°C

Warranty 1 Year

Performance

Nominal Flow Rate	Range A:	0, 0.02, 0.03, 0.05, 0.08, 0.12, 0.20, 0.30, 0.50, 0.75, 1.0, 3.0
	Range E:	0, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 1.0
Flow Accuracy	±10% of setting at 1 lpm and above, ±20% of setting below 1 lpm	
Nominal Input Pressure	400 kPa (58 psi)	
Effect on accuracy as a result of:		
i) varying inlet pressure	Less than 0.5% of reading for ±40 kPa (i.e. ±10%) change in input pressure	
ii) varying outlet resistance	Less than 1% of reading up to 5kPa (50cmH ₂ O) back pressure	
iii) varying temperature	Less than 5% of reading in the range 0 – 40°C	
Delivery Hose	6.0 mm inside diameter	

8.0 Cleaning

This device should be cleaned in accordance with hospital procedures to low level disinfection standard. To clean, use a mild disinfectant detergent solution or alcohol based disinfectant on all external surfaces.

9.0 Procedures for Periodic Inspection

The following safety warnings apply, please read them carefully before you proceed: W1, W3, W5, W6, W7, W8, W9, W10, W11, W12, W13, W15, W16, W17, W18, W19, W20, W21, W22 and W23

All Micro Flowmeters should be cleaned, inspected, and tested to ensure proper performance. The frequency of this work is dependant on usage. As a guideline, it should be completed every 6 months if micro flowmeter is used heavily. If only light use is made of the flowmeter then this period can be extended to 12 months. All flowmeters should be checked regularly at least every year.

- Inspect the Micro Flowmeter for signs of general damage or disrepair.
- Check that the input and output probes are secure and cannot be moved in relation to the main body.
- Check that the decal label is in place and can be seen at each setting.
- Starting at zero turn the flowmeter control knob anti-clockwise through each position and ensure that the control knob rotates smoothly and there is a detent at each flow setting.
- Connect the Micro Flowmeter to a 400 kPa oxygen supply and, in accordance with the procedure given below, check the actual gas flow at each setting.
- Check the Service Due date

10.0 Procedures for Checking Flow Accuracy

The following safety warnings apply. Please read them carefully before you proceed: W1, W3, W5, W6, W7, W8, W9, W10, W11, W12, W13, W15, W16, W17, W18, W19, W20, W21, W22 and W23

To verify the flow rates a mass flowmeter calibrated in standard litres per minute (ls/min) with an accuracy and resolution better than 10% of reading down to 10 mls/min is required (suitable measuring equipment is available - refer Spare Parts, Section 12).

10.1 Flow Rate Test

Connect the micro flowmeter to a 400 kPa oxygen source.

Check the flow rate at each flow setting is within tolerance ($\pm 10\%$ of setting at 1 lpm and above, $\pm 20\%$ of setting below 1 lpm).

Adjustment of individual holes is not possible, however, if all readings are high or low then limited calibration is possible. Refer Section 10.2 for further details.

10.2 Flowmeter Leak Through

Connect the micro flowmeter to a 400 kPa oxygen source.

Set the micro flowmeter to zero setting.

Connect one end of a length of hose to the micro flowmeter output barb and rest the other in a glass of water, not exceeding 5cm in depth. Ensure that there are no gas bubbles coming from the length of hose.

11.0 Procedures for Servicing & Repair

11.1 Flowmeter Disassembly

The following General Safety Warnings apply: W1, W5, W6, W12, W13, W20 & W23

- a) Disconnect the Micro Flowmeter from the gas supply.
- b) Remove Equipment Rating Label.
- c) Remove the M4 Countersunk Screw and pull the Control Knob away from the Flowmeter Body

Note: take care not to lose the Detent Ball and Detent Spring that will be loose when the Control Knob is removed.

- d) Remove and discard the Screw Cover Label at the bottom of the flowmeter to gain access to the securing screws.
- e) Remove the 4 securing screws (refer fig 1 & 2) using a 2.5 mm AF Allen Key and ease the Flowmeter Output Body away from the Input Body.

Note: The two longer screws also serve to secure the Regulator Input Probe.

- f) Loosen the Grub Screw accessed via the hole located between the longer securing screws using a 1.5 mm AF Allen Key. Remove the Probe Regulator Assembly from the Flowmeter Input Body

- g) Slide the Carrier Plate Assembly off of the Drive Shaft.

Note: Do not do disassemble the Carrier Plate Assembly unless there is reason to believe that the filter has become contaminated or one of the flow orifices has been compromised.

- h) Remove the Drive Shaft by pressing it through from the Control Knob side.

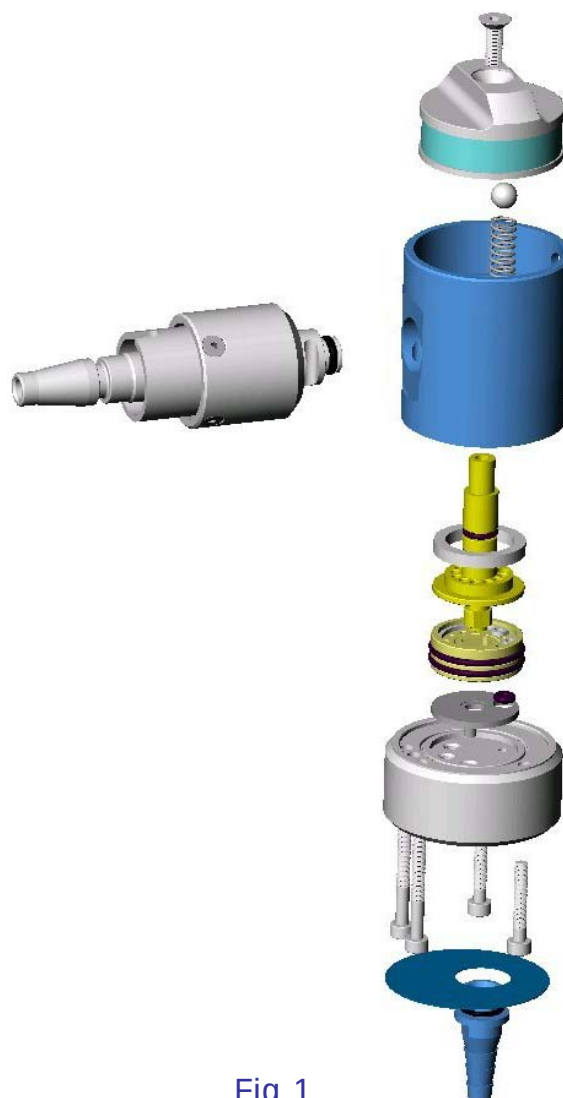


Fig 1

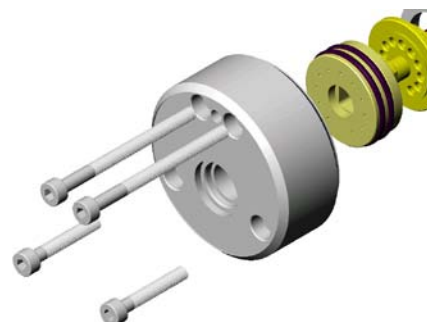


Fig 2

Micro Flowmeter

11.2 Probe Regulator

The Probe Regulator is designed to reduce the wall outlet pressure from a typical value of say 400 kPa to around 100 kPa. This provides a stable pressure supply with which to drive the very low flows used in micro flow irrespective of the wall outlet pressure. It also smooths out the affects of spurious line pressure changes caused by other equipment.

The Probe Regulator requires no servicing and will provide fault free service for the life of the micro flowmeter. However, should failure occur then the Probe Regulator is replaced as a complete assembly.

Disassembly

- To remove the Probe Regulator Assembly first remove the Screw Cover Label at the base of the Micro Flowmeter.
- Using a 2.5mm A/F Allen Key withdraw the two M3 x 35mm Screws shown in fig 2 & 3.
- Using a 1.5 mm A/F Allen Key remove the two grub screws used to lock the Probe Regulator.

Adjustment

The output pressure of the Probe Regulator is adjustable. However, it should be remembered that any adjustment in output pressure will have a proportional affect on the flow at every flow setting.

- Using a 1.25 mm A/F Allen Key remove the four lock screws, one from each of the four holes in the end of the Probe Regulator (refer fig 5).
- Using the same Allen Key, adjust the output pressure by turning the four remaining grub screws either in or out in turn. Turning each adjustment screw clockwise (in) will increase the output pressure (i.e. flow) and counter clockwise (out) will reduce the output pressure.

The amount of adjustment required is determined empirically. Adjust, by 1/8 turn of the Allen Key at a time, each of the four screws and check the flow rate. Repeat until the desired flow is required.

Note:- Always adjust the four grub screws by an equal amount so that their ends remain at the same height.

- Once the desired flow has been achieved replace the four lock screws.

Note:- Apply a very small amount of Loctite 222 Thread Lock Compound on each of the lock screws before refitting.

Note:- When refitting, screw the lock screws in until they lightly touch the adjusting screws. Do not overtighten as this will change the setting of the Probe Regulator output.

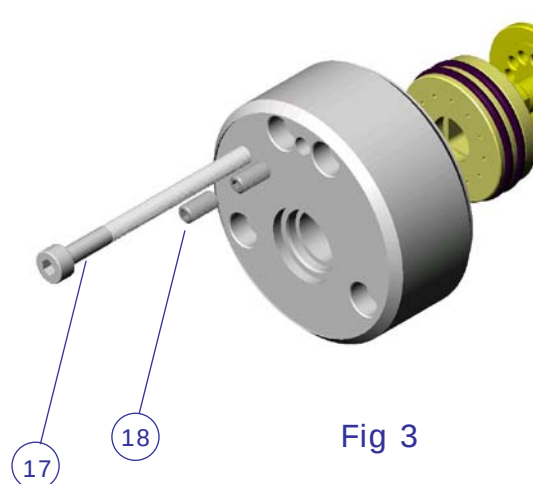


Fig 3



Fig 4 - Probe Regulator



Fig 5

Adjustment
Screws x 4

Micro Flowmeter

11.3 Servicing

The following General Safety Warnings apply: W1, W5, W6, W12, W13, W20 & W23

- Disassemble the flowmeter as described in Section 11.1
- Using Isopropanol Alcohol (IPA) and a lint free wipe, clean the inside of the flowmeter to remove any residue.
- Look at the general condition of the Flow Plate Carrier; unless there is reason to believe that the filter or the metering plate has become contaminated, the Carrier Plate Assembly should not be disassembled.

- Remove the Output O-ring Seal from the PTFE Bearing and replace with a new seal (refer fig 6)
- Remove the two Drive Spindle O-ring seals and replace.

Notes:- Apply a small amount of Krytox Grease to the Drive Spindle O-rings before re-assembly

- Assembly is the reverse of disassembly

Notes: Replacement Screw Cover Labels and Rating Labels are available in the service kit



Fig 6

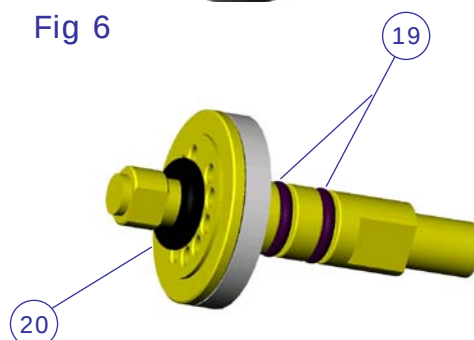


Fig 7

11.4 Labelling

Replacement Rating labels are provided as part of the Service Kit (refer Section 12.1)

- Add the correct serial number and part number to the replacement label to be applied.
- Add the SERVICE DUE date, which should be 24 months from the date of its last service.
- Apply the clear plastic sealing layer of the label to protect the information just added.
- Apply the label to the Micro Flowmeter.

11.5 DISS Humidifier Fitting

Micro Flowmeters can be fitted with a DISS connector that mates with bubble humidifier packages that are commonly used. Refer fig 8 & 9.

- Remove the Output Barb Assembly using a 7 mm A/F spanner.
- Place the Hydrophobic Filter, smooth side facing out, in the Output Body as shown in fig 9.

Fit the DISS fitting assembly with a 10 mm A/F spanner.

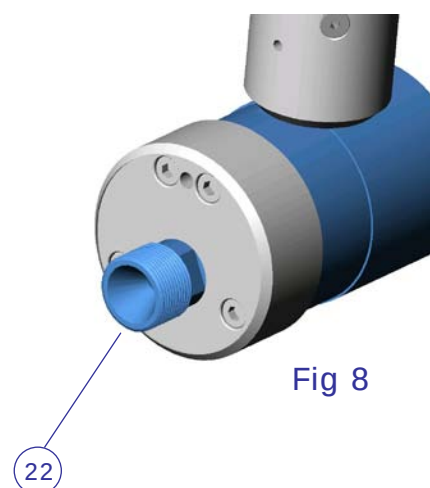


Fig 8

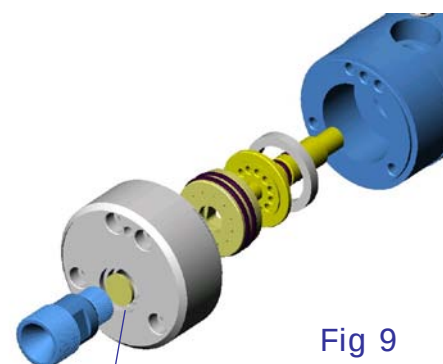
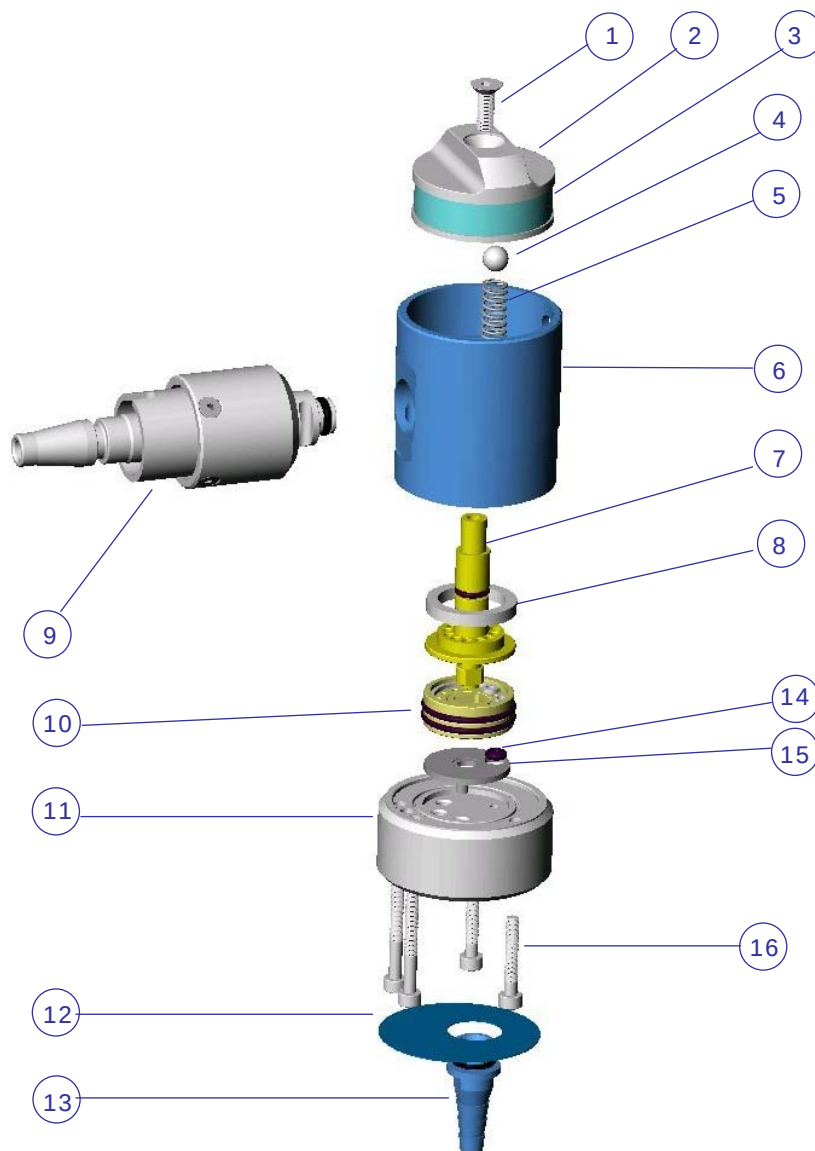


Fig 9

Hydrophobic filter
(included in DISS Kit)

Micro Flowmeter



Ident	Pt. No.	Description	Qty
1	201 0025	Screw, M4 x 16	1
2	602 0095	Control Knob	1
3	*	Decal Label	1
4	214 0001	Detent Ball	1
5	213 0007	Detent Spring	1
6	602 0084	Input Body	1
7	602 0088	Drive Spindle	1
8	602 0089	Spindle Slider	1
9	605 0025	Probe Regulator Assembly	1
10	*	Carrier Plate Assembly	1
11	602 0085	Output Body	1
12	703 0111	Screw Cover Label	1
13	604 0034	Output Barb Assembly	1
14	212 0015	Output O-ring Seal	1
15	602 0087	Output Slider	1
16	201 0029	Screw, M3 x 20	2
17	201 0037	Screw, M3 x 35	2
18	201 0021	Grub Screw, M3 x 6	2
19	212 0041	O-ring, 5.5 x 1.5	2
20	212 0018	O-ring, 5 x 2.5	1
21	212 0016	O-ring, 23 x 1.0	1
22	604 0035	DISS Assembly, including hydrophobic filter	1

* Part number range dependant

12.0 Service Kits

Parts are identified by Part Number throughout this manual and in most cases can be purchased individually. Small, low cost items are generally provided in multiples or in kit form as given below.

12.1 Service Parts & Kits

Part No.	Description	Contents
610 0040	Micro Flowmeter Service Kit (5) <i>Suitable for 816 xxxx models only</i>	5 x Output O-ring Seal 5 x Screw Cover Label 5 x Equipment Rating Label 10 x Spindle O-rings
610 0043	Equipment Rating Labels, Pk 5	
610 0044	Screw Cover Labels, Pk 5	
610 0045	Output O-ring Seal, Pk 5	
610 0046	Loctite 222 Threadlocker	
610 0047	Krytox LC025 Oxygen Tolerant Grease	